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Towards Green Smart City Through Providing Open Space for Cities in Indonesia: Systematic and Bibliometric Literature Review

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Abstract: Smart cities become benchmarks in development cities around the world since the 1990s. In the urban planning context, there are concerns regarding the application of the smart city concept which is considered to only prioritize the progress of cities by technology however no notice to the ecological side of the city. This research discusses the development and arrangement of cities through planning that ensures ecosystem balance, one of which is through open space, which in this case is widely discussed that is green open space. The usual problem that occurs during the development of green open space is not enough land area for available allocation causing an imbalance ecosystem as well as against the sustainability concept. This research method studies literature systematic and bibliometric using Microsoft Excel and VOSviewer from discussion theory and policy about green open space that has been planned in various countries for can applied to cities in Indonesia. The analysis explains the discussion regarding green open space in connection to moving towards a green smart application to cities in Indonesia. Eventually, the findings from this research are discussed related to implementation in the cities in Indonesia which are divided into five aspects, namely political land development, community perception, infrastructure, landscape design, and socio-economic psychology. The final recommendation is that this aspect can be studied further to be applied to cities in Indonesia to realize city smart green future.

Keywords: *smart city, green open space, systematic review, bibliometrics*

Introduction

The smart city concept has gained international attention. In the beginning, the concept the used in the United States to serve enhancement application technology information and communications (ICT) on infrastructure in modern urban surroundings in 1990. In this case, ICT is the fundamental element of smart city development, however, some consider it only as an additional tool for building social capital and increasing efficiency in daily city operations. There are opinions that this concept needs to consider many other aspects of urban life and place human value on things other than technology. In the context of urban planning, there are concerns about the use of the smart city concept which is considered not to pay attention to the ecological side of the city [1]. Apart from that, in the last 10 years, since the introduction of the Sustainable Development Goals (SDGs) by the United Nations, governments in various countries have focused on efforts to resolve global strategic issues such as climate change, global warming, urbanization, poverty and inequality that threaten the environment, social and economic life of society, through various urban planning concepts. Old planning concepts were redeveloped to support the accelerated realization of this world program [2]. One of the concepts put forward by Ebenezer Howard, namely garden city, is currently a concept that is inspiring the 11th sustainable development goal, namely sustainable city by developing lots of land for open space, especially with greening also called green open space.

Cities that decline to carry out ecological development will reduce the availability of natural resources. Urban management must help take steps toward a more ecological city [3]. With the green concept in the city, namely green open space, it can have a sustainable impact. Green open space is a component of urban space that has an important function in maintaining ecosystem balance, especially in urban areas that are

relatively denser in population and activities [4]. The loss of natural and semi-natural ecosystems is the biggest challenge to achieving sustainable development. In this case, if there is less green open space, things will happen such as reduced carbon absorption, more air pollution, and unabsorbed water runoff will not be possible [5]. Apart from that, in the current era of climate change, the loss of vital green space, especially in urban areas, can increase urban temperatures. As a result, urban heat stress negatively impacts the quality of life of city residents. With the depletion of green open space, urban resilience is negatively affected because there is a decrease in thermal comfort, making people consume more electrical energy to increase temperature cooling, thus damaging the city's thermal environment. Apart from that, Government Regulation (PP) no. 21 of 2021 concerning the Implementation of Spatial Planning, this green open space is also regulated in the provisions of statutory regulations, where the amount of green open space is set at 30% of the city area with a proportion of 20% public green open space and 10% private green open space. In its implementation in various cities, most cities in Indonesia have not succeeded in meeting these achievements.

This research was conducted based on the research question, how can the concept of planning toward a green smart city through the provision of open space be applied to cities in the world? What are the characteristics and methods as well as innovation and policy support implemented? It has the aim of being adopted by cities in Indonesia. This literature review was carried out by reviewing previous research which discusses relevant topics from various angles which can theoretically provide the concept of a smart and sustainable city and practically support the global agenda, Sustainable Development Goals in achieving a green smart city through the provision of green open space. The method in this research uses a systematic and bibliometric literature review that discusses theories regarding the provision of open space, especially green open space, in various countries. This research can fill the knowledge gap related to the concept of a green smart city. The findings of this research are then specifically discussed in the context of potential applications for cities in Indonesia to help stakeholders provide insight into the importance of providing green open space as a potential alternative concept for realizing one of the components of a smart city that still prioritizes sustainable principles.

Methods

This research aims to answer the question proposed research by reviewing systematic literature and bibliometrics. A systematic review was carried out for surveyed articles and ultimately included in a structured manner so that they could be researched further. This research is a qualitative research study regarding differences in methods and characteristics as well as innovation and policies implemented for open space as the main keywords. This research method is comprehensive because it includes research on different locations and variables then compiled by summarizing the findings from various studies [6]. The method adopted in this research will be structured to include several steps to collect and analyze literature on the existence of open space or in this case open space towards a green smart city. The stages carried out in this systematic and bibliometric literature review method include:

a. restrictions scope and definition of problem

b. election results

c. filtering as literature

From a search using keywords as a scope limitation with a scientific article collection platform, namely Dimensions with the keywords green open space AND urban planning AND smart city, which in this case is for open space. Apart from that, the overall data was grouped before carrying out two-level filtering with VOSviewer which has advantages, especially in the form of integration of all data to narrow discussions related to open space into green open space in smart city spatial planning so that 413,223 articles publications were found. Then in the first level of screening, this large number of articles are filtered through a two-step process. In the first step, several articles were selected by reading the abstract and related research titles for each year covering 2019-2023, resulting in a total of 52 articles. Followed by a second level of screening carried out to select quality articles that were appropriate to the adaptation location, namely the city. -the best city in the world. Finally, after two levels of filtering, there were 5 research articles from each year and one article each to be studied further in discussions related to the study of open space, especially green open space in a city (**Figure 1**).

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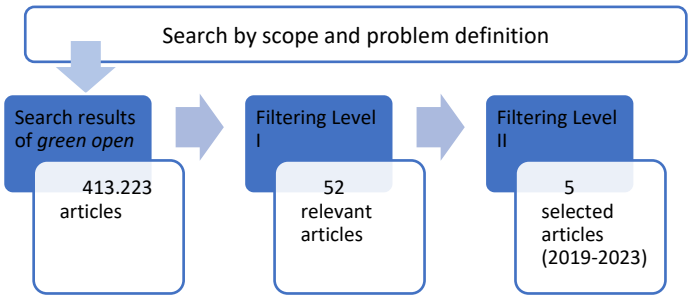

Figure 1. Article Selection Flow Charts

Results And Discussion

In the initial part, keyword search results were first identified based on four things, namely theme, author, university, and country which discussed the main keyword, namely green open space. From visualization using VOSviewer, the minimum number of articles and references is each set at 5, and the results based on themes are presented in the following **Figure 2**.

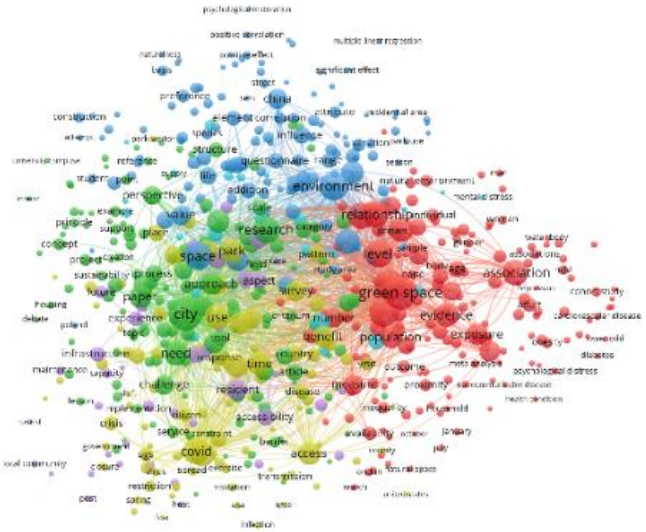

Figure 2. Search Results by Theme

Based on the picture above is known that from the search results regarding open space, there is a lot of discussion regarding Green Space or green open space in the red cluster, followed by cities in the green cluster, the environment in the blue cluster, and COVID-19 in the yellow cluster. Of the four clusters, some categorizations have meaning related to research on the topic of Open Space (**Table 1**).

Table 1. Categorization theme according to main keywords.

No	Cluster	Keywords	identification meaning
1	Red	*Green space*	Topic more especially frequently researched about green open space
2	Green	*City*	Scope discussion handles green open space in the city
3	Blue	*Environment*	Discussion about green open spaces and their impact on the environment
4	Yellow	*Covid*	Linkage green open space with COVID as one effort to mitigate future pandemics

Furthermore, explained results from keyword searches mainly based on many authors, universities, and countries related to green open space are displayed with visualization by VOSviewer (**Figure 3-Figure 5**).

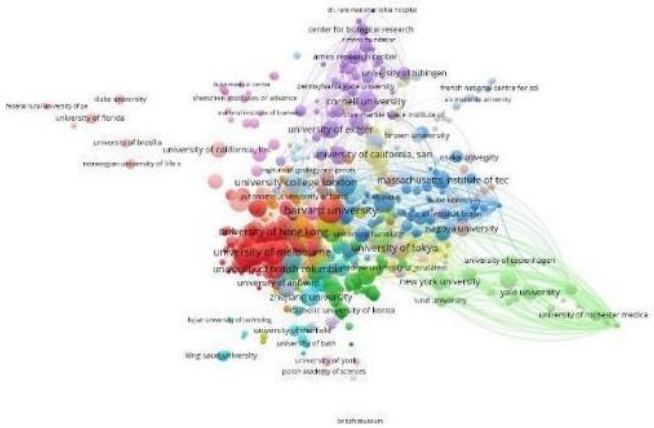

Figure 3. Search Results Based on Writer

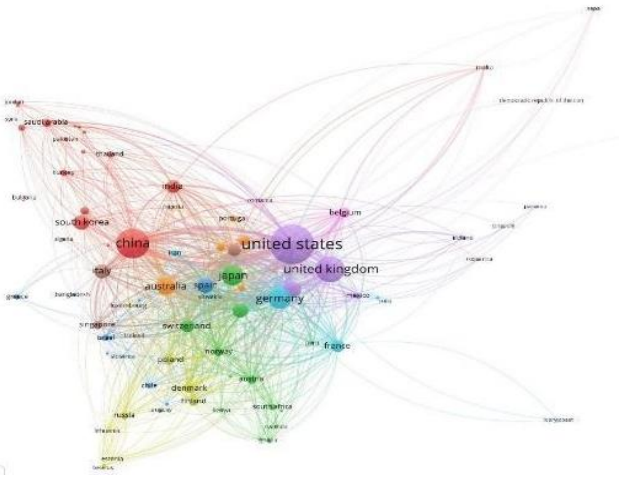

Figure 4. Search Results Based on the University

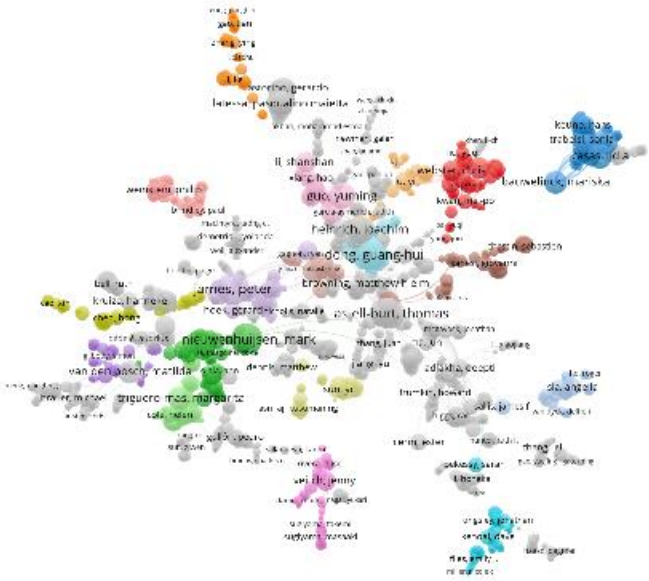

Figure 5. Search Results by Country

Based on the visualization results via VOSviewer above based on authors, universities, and countries, it shows that the three are related, where the two countries that have a lot of research regarding green open spaces, namely America and China, which also represent the universities that are most discussed, namely Harvard University and the University of Hong Kong as neighbors of China and The author who has conducted a lot of research on the topic of green open spaces is Guang-Hui from China, followed by Mark from America.

Furthermore, a large number of articles were selected for this research which were conducted in different locations from 2016 to 2021. The five years was chosen based on its suitability to the topic of discussion related to the provision of green open space which has developed in recent years. There is a summary of findings from all selected articles in one format using Microsoft Excel. From the results of the systematic literature review and bibliometrics, four points can be identified, namely characteristics, methods, innovation, and policies, which can then be adapted by Indonesian cities towards green smart cities.

Study results in the literature in a way systematic disclose that the growth of fast cities gives rise to lots of problems environment. One method for overcoming the problem is to increase the use of green open space to guard a balanced ecosystem, especially in urban areas.

In the characteristics section, it is known that the focus groups of each city development have different discussions, namely the politics of land development, community perception, infrastructure, landscape design, and psycho-socio-economics. Studies on land focus on the decline and reduction of green areas which include political issues related to land development. Community perception is the main capital in providing green open space that can function fully by looking at the level of community satisfaction. Infrastructure development related to the blue-green concept increasingly shows that it is important to provide green open space. Construction management that can be carried out through landscape design for green open spaces can ensure detailed functions in the ecosystem. Psycho-socioeconomic barriers to community diversity can create an unfair function of green open space for all groups. The characteristics and methods of each article are explained in the following **Table 2**.

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Table 2. Characteristics and Existing Methods

TITLE	CHARACTERISTICS AND METHODS	SOURCE
The ecological politics surrounding downsizing and downgrading Of public parks: a reflection on the history of change in Harare Gardens in Zimbabwe	Study of the decline and reduction of protected areas in Africa. Operationalization of the study involved interviews with various stakeholders including city officials and experts in urban planning and conservation, as well as observation and examination of published documents.	[7]
Factors influencing users' satisfaction with urban parks through online comments data: evidence from Shenzhen, china	Research potential obstacles faced by city parks in their function so that they can further meet the needs of residents in terms of collective perception and satisfaction. The use of social media data in the form of sentiment analysis to investigate potential factors that influence public satisfaction with city parks.	[8]
Assessing the influence of urban greenness and green stormwater infrastructure on hydrology from satellite remote sensing	Urban greenness has a significant influence on downstream flow response, so that on average, a 10% increase in greenness indicates a reduction in total available stormwater flow. Measured with satellite imagery via spectral indices such as the Normalized Difference Vegetation Index (NDVI).	[9]
The digital landscape design and layout of wetlands based on green ecology	The landscape design and layout uses green ecology as the support and digital technology as the driving force to improve the construction of the ecological environment and management of wetland resources. Based on the parametric software platforms 3D Max, Grasshopper, and ArcGIS, 3D digital simulation and plant community landscape layout are realized obtaining an objective evaluation of the landscape pattern of the design scheme.	[10]
Examining psychosocial and economic barriers to green space access for racialized individuals and families: a narrative literature review of the evidence to date	Identify psycho-socioeconomic barriers to green space access for racialized individuals/families and Black Indigenous People of Color. A narrative systematic review was conducted to identify barriers to green space access for individuals/families and Black Indigenous People of Color.	[11]

Based on the various characteristics and methods applied in various cities, it shows various kinds of applications from the political aspects of land development, community perception, supporting infrastructure, landscape design, and psycho-socioeconomics which have different focuses but have the same principle, namely achieving sustainability. The important criteria for a green smart city, in this case ecologically, is the need for stakeholder planning to ensure that all partners will work together in providing green open space. Sustainable urban management is just the beginning. Observing community behaviour is the final goal that is needed by involving them in the development and development process. The level of satisfaction through reviews or comments on a link, especially regarding green open spaces in the current smart city era, is very important to study to fulfil their needs. Implementing appropriate planning is an opportunity for a city to show what it can offer as a viable city and generate additional investment to increase its attractiveness so that in the future a city needs to move towards a green, smart city.

Implementation of the provision of green open space can emerge based on innovation that is beneficial to the community and can then run with policies that support it. From the cities in various countries in this selected article, we found innovations and policies that support the provision of green open space as an effort to implement a green smart city. From the literature review, planning strategies towards a green smart city provide programs for various aspects including political land development, community perception, supporting infrastructure, landscape design, and psycho-socio-economics. Innovations and policies in green open spaces are explained in the following **Table 3**.

Table 3. Innovations and Implemented Policies

Title	Innovation and Policy	Source
The ecological politics surrounding downsizing and downgrading of public parks: a reflection on the history of change in the Harare Gardens in Zimbabwe	Downscaling is explained through ecodevelopment and politics takes a role central in handling it. Making decisions by the authorities in a way political.	[7]
Factors influencing users' satisfaction with urban parks through online comments data: evidence from Shenzhen, china	Nine main factors of urban parks that influence user satisfaction, in addition to factors common to previous research include park size, vegetation, recreation facilities, visual effects of the landscape, maintenance of facilities and plants, and environmental cleanliness. A series of contextual factors also significantly influence community satisfaction, such as sign systems, mosquitoes and air quality. Managerial guidelines for planners and decision-makers to optimize the quality of urban life that is important for society.	[8]
Assessing the influence of urban greenness and green stormwater infrastructure on hydrology from satellite remote sensing	Green stormwater infrastructure (GSI), which includes features such as rain gardens, constructed wetlands, or urban tree canopies, is now widely recognized as a means to reduce the impact of urban runoff and meet municipal water quality permits. Assessment and verification of additional benefits of GSI in urban landscapes at the watershed scale.	[9]
The digital landscape design and layout of wetlands based on green ecology	Concepts were formed, including the integration of biodiversity protection and natural plants, the integration of water purification and plant diversity, and the integration of ecology and recreation. The wetland landscape design presented is clear, accurate and efficient, and the layout of the plant landscape is in accordance with the concept of green social ecological development.	[10]
Examining psychosocial and economic barriers to green space access for racialized individuals and families: a narrative literature review of the evidence to date	Interpersonal, practical (such as transportation costs, entrance fees and lodging costs) and environmental factors can act as barriers to green space access for racialized individuals/families. The most frequently reported barriers were perceived safety and costs associated with traveling and accessing green spaces, especially for families. Such factors as diversity-friendly schemes (e.g., multiple languages on signage and additional prayer spaces in parks), funding, and strategies to improve safety should be considered in the design and commissioning of green spaces and green social initiatives in primary care. By reducing these barriers green spaces can become more accessible and increase inclusivity for racialized individuals/families.	[11]

From the comprehensive literature, various focuses show the necessity of cooperation in all related aspects with the development of green open space. Here, power and political role are important in making correct decisions, based on analysis of the availability of land, infrastructure support, needs of society, balance as well as landscaping in the ecosystem.

Conclusions

This research ultimately answers research questions regarding the characteristics and methods of providing green open space in cities in various countries that often research this matter and have successfully implemented it and are known for their innovations and policies in this effort towards a green smart city. In the discussion, there are different focuses, namely on the politics of land development, community perception, supporting infrastructure, landscape design, and psycho-socioeconomics.

From these various focus aspects, it can then be adopted to implement the provision of green open space in Indonesia, which can be carried out sequentially, including:

1. Land development politics
   The process of making wise decisions in land development is not to ignore green areas, especially green open spaces in the context of urban planning.

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2. Public perception
   Consider community satisfaction in maximizing the function of green open spaces by utilizing social media to review each green open space location that has been visited as an evaluation point.
3. Infrastructure
   Blue-green infrastructure development with sustainable principles where the supporting infrastructure is intelligent and still pays attention to the environment, one of which is by providing green open space as a catchment area for runoff water in urban areas.
4. Landscape design
   important to improve the aesthetics of a green open space in a detailed design to maintain the balance of the ecosystem and the comfort of the community.
5. Socio-economic psycho
   Equal treatment for various levels of urban society in gaining fair access to green open spaces, for example by determining pocket-friendly entrance fees.

Eventually, it is hoped that cities in Indonesia can fulfil the people's needs for the right to experience green open space as an important component of a green smart city where the city they live in is suitable and comfortable in terms of modernity and the environment.

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